

## **Nanomedicine: Principles and Applications**

**ENG BE/EC 745 (4 credits), Spring 2016**

Tuesdays, Thursdays 10 am - 12 pm, PHO 901

Course Instructor: Mario Cabodi ([cabodi@bu.edu](mailto:cabodi@bu.edu))

*Course description:* The use of nanoscience and technology for biomedical problems has spawned a field of applications ranging from nanoparticles for imaging and therapeutics, to biosensors for disease diagnostics. Nanomedicine is a rapidly growing field that exploits the novel properties of nanoscale materials and techniques to rapidly advance our understanding of human biology and the practice of medicine.

This course focuses on the fundamental properties, synthesis and characterization of nanomaterials, coupled with their applications in nanomedicine, including: micro- and nanoparticles for drug delivery and imaging, microfluidics for *in vitro* diagnostics, nanomaterials and platforms for biological applications. The biomedical applications include cancer, cardiovascular disease, and infectious diseases.

*Course prerequisites:* BE 605, EC 481 or permission of instructor.

### *Testing:*

The students' understanding of the material will be evaluated with both problem sets, a mid-term paper, and a final project. For the final project, the students will develop a proposal based on the nanomedicine topics introduced during the course.

The breakdown for the grade will be: 40% homework assignments, 30% mid-term paper, 30% final project and presentation.

### *Sources used during the course:*

Background reading, references, chapters, review articles; slides or lecture notes, hand-outs.

Date	Topic
1/19/16	Introduction: course structure, assignments
1/21/16	Scaling behavior, surfaces, surface modifications
1/26/16	Nanofabrication primer
1/28/16	Surface patterning for biological applications
2/2/16	Imaging, targeting, microparticles
2/4/16	Clinical imaging <i>(in-class proposal discussion)</i>
2/9/16	Cardiovascular nanomedicine
2/11/16	Microscale transport, diffusion and drug delivery
2/16/16	<i>Monday Schedule - No Class</i>
2/18/16	Drug delivery in detail
2/23/16	Cancer clinical overview
2/25/16	Cancer treatments: overview
3/1/16	Hallmarks of cancer
3/3/16	Nanoparticles: polymeric, dendrimers <i>(in-class discussion)</i>
3/8/16	<i>Spring Break</i>
3/10/16	<i>Spring Break</i>
3/15/16	Nanoparticles (lipids); synthesis and applications
3/17/16	<i>In-class Presentations</i>
3/22/16	Nanoscale properties of matter (QM, QDs, ZMWs)
3/24/16	Quantum Dots; plasmonics; metal NPs
3/29/16	NP characterization
3/31/16	Infectious Disease Basics, Vaccines <i>(in-class discussion)</i>
4/5/16	Medical Diagnostics
4/7/16	Microfluidics – Fundamentals
4/12/16	Microfluidics – Applications
4/14/16	Biosensors, NEMS biosensors
4/19/16	Nanofabricated substrates for cellular and molecular studies
4/21/16	<i>Final proposal discussion (teams)</i>
4/26/16	Nanomedicine commercialization - Course wrap-up
4/28/16	<i>In-class Presentations</i> and evaluations